

CLAIMS:

Having thus described the invention, what is claimed and desired to be secured by Letters Patent is:

1. In a multi-stage turbine fuel pump for automotive vehicles, the pump having an inlet section through which low pressure fuel is drawn into the pump, a first pump stage and a second pump stage, and an outlet section through which high pressure fuel is discharged from the pump, the improvement comprising alignment means for assembling together and properly aligning components comprising the respective first and second pump stages, the alignment means maintaining alignment of the components during and after pump assembly and dissipating forces which otherwise would be concentrated about the alignment means which could cause failure of the components.

2. The fuel pump improvement of claim 1 in which the inlet section includes an end cap having an opening therein through which fuel is drawn into the pump, the first pump stage includes including an impeller and a port plate in which the impeller is installed, the second stage the port plate and a casing in which a second impeller is installed, and the alignment means includes means extending between the end cap, port plate, and casing to align the inlet section and pump stages.

3. The fuel pump improvement of claim 2 in which the alignment means includes a spring pin extending between the end cap and the casing for the second pump stage to align the components together, and an open channel formed in each of the end cap and casing in which the spring pin is received.

4. The fuel pump improvement of claim 3 further including a second spring pin for aligning the components, and a second open channel formed in each of the end cap, port plate, and casing in which the second spring pin is received.

5. The fuel pump improvement of claim 4 in which the end cap has first and second recesses formed therein for receiving one end of each spring pin and the casing has first and second recesses formed therein for receiving the other end of each spring pin.

6. The fuel pump improvement of claim 5 wherein the port plate has open sided, spaced channels formed therein through which each of the spring pins extends.

7. The fuel pump improvement of claim 6 in which each spring pin has a hollow, cylindrical shape with a longitudinal slot extending the length of the pin.

8. The fuel pump improvement of claim 7 in which the recesses formed in the end cap and casing and the channels formed in the port plate through which the spring pins are inserted to align the components all open into a sidewall of the respective component so forces transmitted from a spring pin to the component are dissipated through the component rather than concentrated about the recess or channel, thereby to prevent cracking of the component.

9. The fuel pump improvement of claim 8 in which the pins are made of a spring material, the springs being compressed when the inserted in the channels of the port plate with the pins thereafter expanding against a sidewall of the channel with the force exerted by the pin on the channel sidewall maintaining alignment of the components.

10. The fuel pump improvement of claim 4 in which the two spring pins and the open channels formed in the end cap, port plate, and casing are arranged in a predetermined

angular relationship with each other for proper alignment of the fuel pump components during pump assembly.

11. A multi-stage turbine fuel pump for automotive vehicles comprising:
an inlet section through which low pressure fuel is drawn into the pump;
a first pump stage and a second pump stage;
an outlet section through which high pressure fuel is discharged from the pump; and,
alignment means for aligning the components comprising the respective first and second pump stages, the alignment means maintaining alignment of the components during and after the pump is assembled and dissipating forces which otherwise would be concentrated about the alignment means which could cause failure of the components.

12. The fuel pump of claim 11 in which the inlet section includes an end cap having an opening therein through which fuel is drawn into the pump, a first pump stage including an impeller and a port plate in which the impeller is mounted, and a second pump stage including a casing and an impeller mounted between the port plate and casing, the alignment means including at least one spring pin extending between the end cap, through the port plate, and into the casing to properly align the inlet section and pump stages together, and an open channel formed in the end cap, port plate, and casing in which the spring pin is received.

13. The fuel pump of claim 12 including a pair of spring pins for connecting the components together, the spring pins being installed on opposite sides of the fuel pump, and an open channel formed in the end cap, port plate, and casing in which each of the spring pins is received.

14. The fuel pump of claim 13 in which the end cap has first and second open sided pockets formed therein for supporting one end of each spring pin and the casing has first and second open sided pockets formed therein for supporting the other end of each spring pin.

15. The fuel pump of claim 14 wherein the port plate for the first pump stage, which is intermediate the end plate and port plate for the second pump stage, has a pair of open sided channels formed therein through which the spring pins extend.

16. The fuel pump of claim 15 in which each spring pin has a hollow, cylindrical shape with a longitudinal slot extending the length of the pin, the pins being made of a spring material, and each pin being compressed when inserted in place for the pin to thereafter press against a sidewall of the channel in which it is inserted, the force exerted by the pin on the channel sidewall maintaining alignment of the components.

17. An alignment means for use in a multistage turbine fuel pump for aligning components comprising respective stages of the pump, the alignment means including a spring pin made of a spring material and the fuel pump components each having an open channel formed therein with the spring pin, when installed in the channel, exerting a force on the components to maintain them in alignment.

18. The alignment means of claim 17 including a pair of substantially identically formed spring pins, the fuel pump components including respective open channels for each pin.

19. The alignment means of claim 18 each spring pin has a hollow, cylindrical shape with a longitudinal slot extending the length of the pin, each pin being compressed when inserted in a channel for the pins to thereafter press against a sidewall of the channel in

which it is inserted, the force exerted by the pin on the channel sidewall holding the components in alignment.

20. The alignment means of claim 19 in which the two spring pins and the open channels formed in which the spring pins are received are arranged in a preferred orientation to properly align the components during pump assembly.

21. The alignment means of claims 19 in which the fuel pump is a two stage fuel pump having an inlet end cap, a first stage port plate and a second stage casing, the inlet end cap, port plate, and casing each having open channels formed therein in which the respective spring pins are received, thereby to dissipate forces transferred from the spring pins to these components rather than concentrating the forces thereabout and causing damage to the components.